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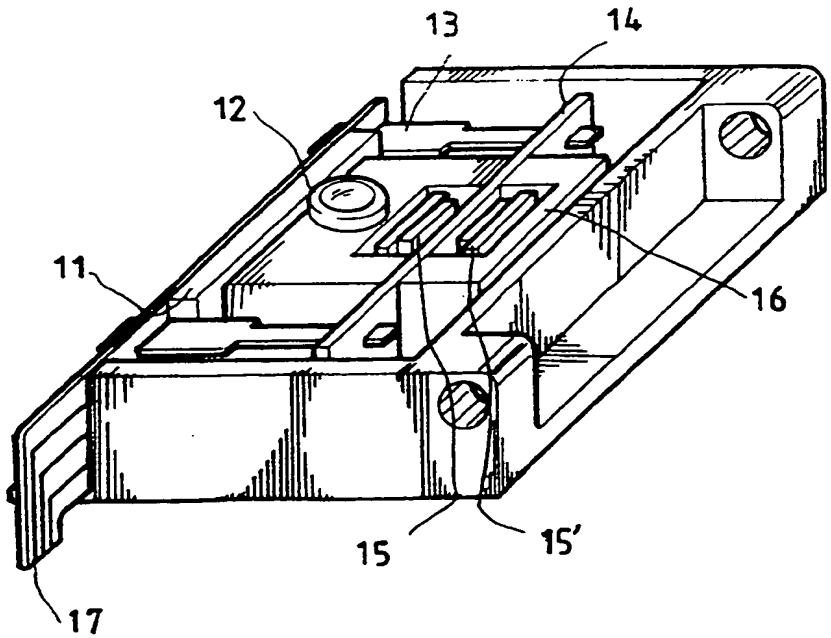
(54) Objects-lens driving device for optical pickup

(57) There is provided an object-lens driving device for an optical pickup, employing such a fine pattern coil (14) as is used in a compact disk player or a laser disk player. The object-lens driving device for an optical pick-up eliminates the rolling phenomenon which use of a wire having a circular cross-section as a supporting member is likely to cause, and thus can control focusing and tracking more stably, since an elastically supporting plate member (13, 33, 43, 53, 63) is used as means for elastically biasing the horizontal or vertical movement of a driving portion body.

FIG. 2



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D scription

The present invention relates to an object-lens driving device for an optical pickup installed in an optical recording and/or reproducing apparatus, and more particularly though not exclusively, to a device for supporting an object-lens driving portion, which elastically supports the object-lens driving portion according to vertical and/or horizontal displacement of the object-lens driving portion.

In a recording/reproducing apparatus employing an optical recording medium (hereinafter referred to as a disk) such as a laser disk player or compact disk player, an optical pickup having an object lens is provided for projecting a light beam (laser beam) onto the surface of the disk and detecting the reflected beam therefrom in order to read recorded digital data as a binary signal. In the operation of the optical pickup, the distance between the object lens and the disk must be kept constant to maintain correct focusing, and precise tracking of the projected light beam is required to reproduce the data on the disk without noise. Working against this, however, is the eccentricity error of the center hole of any manufactured optical disk, which is unavoidable. Once the disk is placed on a turntable, such eccentricity errors create unwanted oscillations in operation which cause reproduction errors. As a result, the distance between the optical disk and the object lens for the optical pickup cannot be kept constant and tracking on the disk is unstable. Therefore, to compensate for reproduction errors and achieve the correct focusing and tracking, a driving portion for slightly moving the object-lens-vertically and/or horizontally - and some form of elastic support for supporting the driving portion are needed. Conventionally, a plurality of wires have been used as elastic supporting means in order to support the body of the driving portion having an object lens installed therein.

Figure 1 illustrates a conventional optical pickup driving device employing wires as elastic supporting means.

As shown in Figure 1, a fine pattern coil 4 is connected to a driving portion body 6 having an object lens 2 thereon. A plurality of wires 3 are provided, one end of each wire being connected to the fine pattern coil 4 and the other end thereof being inserted into a hole formed through a holder 1. The wires 3 serve to support the driving portion body 6.

In the above optical pickup driving device, when a drive current is applied through a power supply unit 7, the current flows to the fine pattern coil 4 via the wires 3. The current flowing through the fine pattern coil 4 and the magnetic force of a pair of magnets 5 and 5' positioned orthogonal to the current direction of the fine pattern coil 4 gen rat an el ctromagnetic forc in accordanc with Fleming's left-hand rule:

$$F = Bl\ell\sin(B_m \perp I_m)$$

where F is lectromagnetic force, $B_m \perp I_m$ is the angle betw en the magnetic force direction and the current direction, B is magnetic force, I is applied current, and ℓ is the length of a conducting wire. Thus, the driving portion body 6 slightly moves depending on the direction of the electromagnetic force, with the wires 3 elastically biasing and supporting the driving portion body 6.

However, use of the wires 3 as a supporting member, which have a circular cross-section, is likely to result in a rolling phenomenon, since each inserted wire 3 makes contact with the holder 1, i.e., the inside of the hole 1a only, over a small surface area, and a gap exists between the hole 1a and the outer circumferential surface of the inserted wire 3. Here, the rolling is a phenomenon that the focus of the object lens 2 appears to rotate, not being constantly converged onto the disk (not shown) during the movement of the driving portion body 6 being controlled for focusing and tracking, which is also the cause of reproduction errors.

An aim of preferred embodiments of the present invention is to provide an object-lens driving device for increasing an area in which an elastic supporting member contacts a holder by using an elastic supporting plate member, so as to eliminate the rolling phenomenon.

According to the present invention, there is provided an object-lens driving device for an optical pickup, comprising a driving portion body having an object lens mounted thereon, an electromagnetic circuit attached to said driving portion body, including a fine pattern coil having a tracking coil and a focusing coil formed on the same plane, and a holder for supporting said driving portion body in cooperation with supporting means, wherein said supporting means has a plurality of plate spring members, one end of each plate spring member being combined with said holder, and the other end thereof being fixed to said driving portion body, for being elastically deformed vertically or horizontally.

Suitably, one side of each of said plate spring members is attached onto said holder.

Many variations can be made according to the mechanism of combining the holder with the plate spring members: a vertical protrusion is extended from the holder, and a combining hole or groove is formed in each of the plate spring members, for receiving the protrusion; insertion holes are alternatively formed through the holder, for receiving the plate spring members, gaps between the holes and the plate spring members being filled with damping members. Each of the plate spring members has a damping member for suppressing oscillations attached to one side thereof which damping member may be an adhesive tape.

According to the present invention, there is further provided a lens driving d vice for an optical pickup, the devic comprising a driving portion body including a lens, means for driving said body portion which driving means includes a holder and at least one generally planar biassing m ans attach d to said holder.

Suitably, the device further comprises any one or more of the features of the accompanying description, claims, abstract and/or drawings, in any combination.

The present invention will become more apparent by describing in detail, by way of example only, a preferred embodiment thereof with reference to the attached drawings in which:

Figure 1 is a perspective view of a conventional object-lens driving device employing wires as a supporting member;

Figure 2 is a perspective view of an object-lens driving device employing plates as a supporting member, according to the present invention;

Figure 3 is an extracted perspective view for showing a first embodiment of combining the plates with a holder in Figure 2;

Figure 4 is an extracted perspective view for showing a second embodiment of combining the plates with a holder in Figure 2;

Figure 5 is an extracted perspective view for showing a third embodiment of combining the plates with a holder in Figure 2; and

Figure 6 is an extracted perspective view for showing a fourth embodiment of combining the plates with a holder in Figure 2.

Figure 2 illustrates an object-lens driving device according to the present invention.

As shown in Figure 2, an object lens 12 is mounted on a driving portion body 16. The driving portion body 16 is also provided with components generally used in an electromagnetic circuit, including opposing permanent magnets 15 and 15', and a fine pattern coil 14 positioned between the permanent magnets 15 and 15' for generating electromagnetic force by interaction with the permanent magnets 15 and 15' according to an applied current.

Here, according to a characteristic of the present invention, a plurality of plate springs 13 are further provided, one end of each plate spring 13 being fixed to a holder 11 and a power supply unit 17 and the other end thereof being fixed to the fine pattern coil 14, to elastically support the driving portion body 16 with respect to the horizontal and vertical movement thereof. A flexible printed circuit board is used as the power supply unit 17.

Now, the operation of the object-lens driving device according to the present invention will be described.

First, current for an rror corr ction signal is appli d from the power supply unit 17 to the fin pattern coil 14 through the plate springs 13 which also s rve as conducting wires, thus forming a current circuit. The current flow generates electromagnetic forc according to Fleming's left-hand rule, through interaction with the magnetic field of th permanent magnets 15 and 15'. Thus, the driving portion body 16 is displaced vertically or horizontally. At the same time, the plate springs 13 support the driving portion body 16 to elastically bias its displacement. Here, the plate springs 13 contact the holder 11 over a large area and a gap therebetween is smaller than that when the wires (see Figure 1) are employed.

The plate springs 13 can be variously modified to be fixed to the holder 11.

Figures 3 through 6 illustrate embodiments of combining plate springs with a holder, in the object-lens driving device according to the present invention.

As shown in Figure 3, plate springs 33 may be attached onto a holder 31, as a way to connect the plate springs 33 to the holder 31.

As shown in Figure 4, cylindrical protrusions 41a are provided on a surface of a holder 41, and combining holes 43a for insertion of the protrusions 41a thereinto are formed in plate springs 43, thus combining the plate springs 43 with the holder 41.

As shown in Figure 5, planar protrusions 51a laterally from a holder 51 are provided, and grooves 53a for receiving the protrusions 51a are formed in edges of plate springs 53, thus combining the plate springs with the holder.

As shown in Figure 6, insertion holes 61a for receiving plate springs 63 are formed through a holder 61. Thus, the plate springs 63 are inserted into the insertion holes 61a, and then the gaps between the plate springs 63 and the holder 61 are filled with damping members 61b.

Further, the damping force can be reinforced by attaching an adhesive tape onto the sides of plate springs as a damping member for suppressing oscillations.

In the object-lens driving device described herein according to the present invention, since a plate spring contacts a holder over a large area and a small gap exists between them as compared that when a wire is employed, the rolling phenomenon, to which the wire is vulnerable when supporting the driving potion body, is eliminated. Consequently, focusing and tracking can be stably controlled.

Though the present invention is described referring to the above embodiment shown in the attached drawings, the embodiment is an exemplary application. Therefore, it is clearly understood that many variations are possible within the scope and spirit of the present invention by those who have ordinary knowledge in the art.

The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are op n to public inspection with this specification, and the cont nts of all such papers and documents ar incorporated herein by refer nce.

All of the f atures disclosed in this specification (in-

cluding any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

Claims

1. An object-lens driving device for an optical pickup, comprising a driving portion body (16) having an object lens (12) mounted thereon, an electromagnetic circuit attached to said driving portion body, including a fine pattern coil (14) having a tracking coil and a focusing coil formed on the same plane, and a holder (11, 31, 41, 51, 61) for supporting said driving portion body (16) in cooperation with supporting means,

   wherein said supporting means has a plurality of plate spring members (13, 33, 43, 53, 63), one end of each plate spring member (13, 33, 43, 53, 63) being combined with said holder (11, 31, 41, 51, 61), and the other end thereof being fixed to said driving portion body (16), for being elastically deformed vertically or horizontally.

2. An object-lens driving device for an optical pickup as claimed in claim 1, wherein one side of each of said plate spring members (13, 33, 43, 53, 63) is attached onto said holder.

3. An object-lens driving device for an optical pickup as claimed in claim 1 or claim 2, wherein each of said plate spring members (13, 33, 43, 53, 63) has a damping member (61b) for suppressing oscillations, which is attached onto a side thereof.

4. An object-lens driving device for an optical pickup as claimed in claim 3, wherein said damping member is an adh siv tap .

5. An object-lens driving device for an optical pickup as claimed in any preceding claim, wherein a protrusion (41a) is protruded vertically from said holder (41), and a combining hole (43a) is formed in each of said plate spring members (43) for receiving said protrusion.

6. An object-lens driving device for an optical pickup as claimed in any one of claims 1 to 4, wherein a protrusion (51a) is protruded horizontally from said holder (51), and a groove (53a) is formed in the edge of each of said plate spring members (53) for receiving said protrusion.

7. An object-lens driving device for an optical pickup as claimed in any one of claims 1 to 4, wherein insertion holes (61a) are formed through said holder (61) for receiving said plate spring members (63), and gaps between said hole (61a) and said plate spring members (63) being filled with damping members (61b).

8. A lens driving device for an optical pickup, the device comprising a driving portion body (16) including a lens (12), means (14) for driving said body portion which driving means includes a holder (11, 31, 41, 51, 61) and at least one generally planar biassing means (13, 33, 43, 53, 63) attached to said holder (11, 31, 41, 51, 61).

9. A lens driving device according to Claim 8, further comprising any one or more of the features of the accompanying descriptions, claims, abstract and/or drawings, in any combination.

FIG. 1 (PRIOR ART)

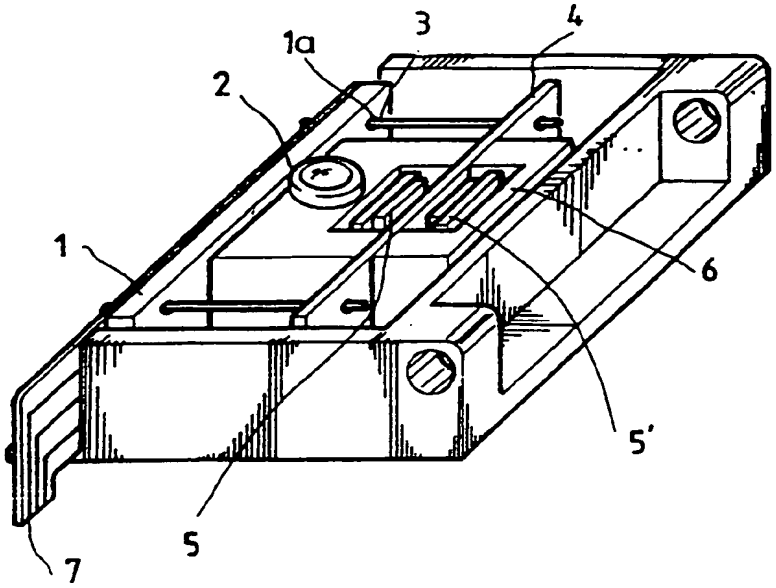


FIG. 2

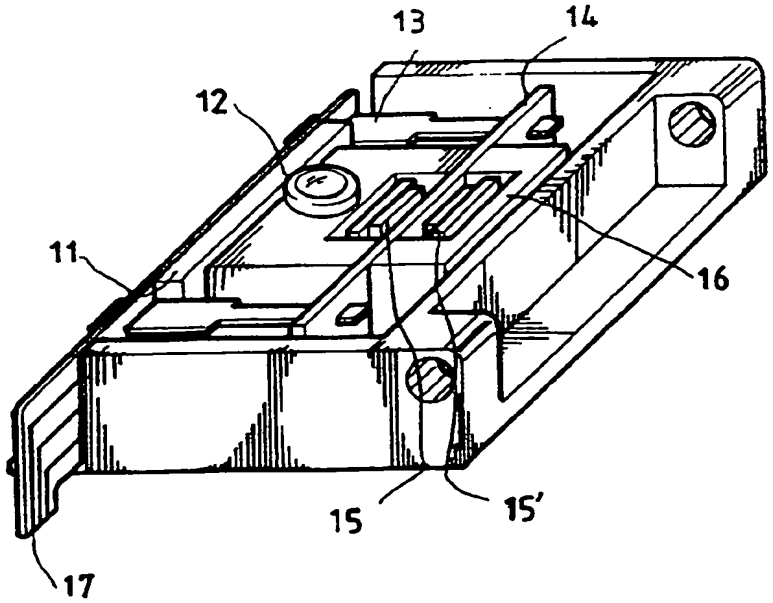


FIG. 3

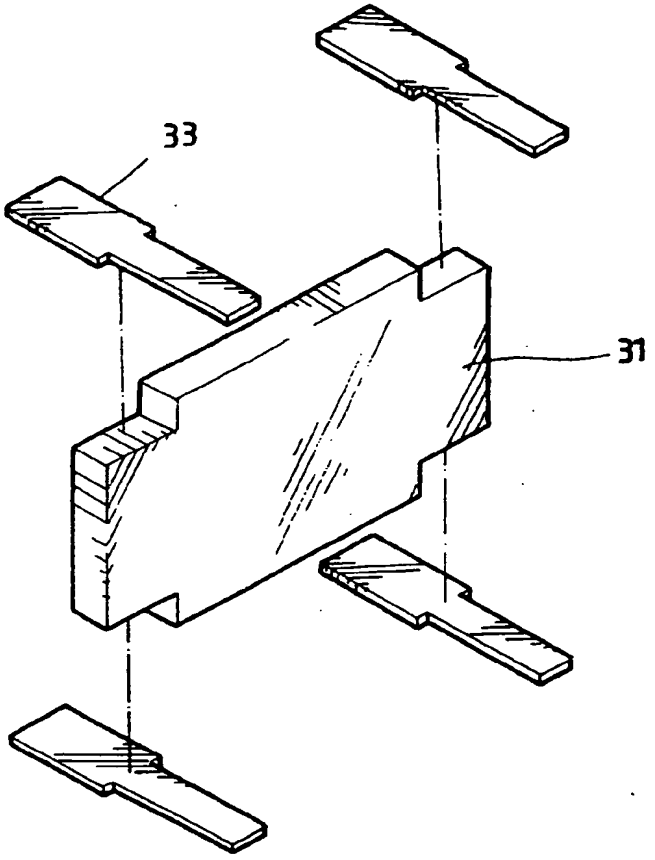


FIG. 4

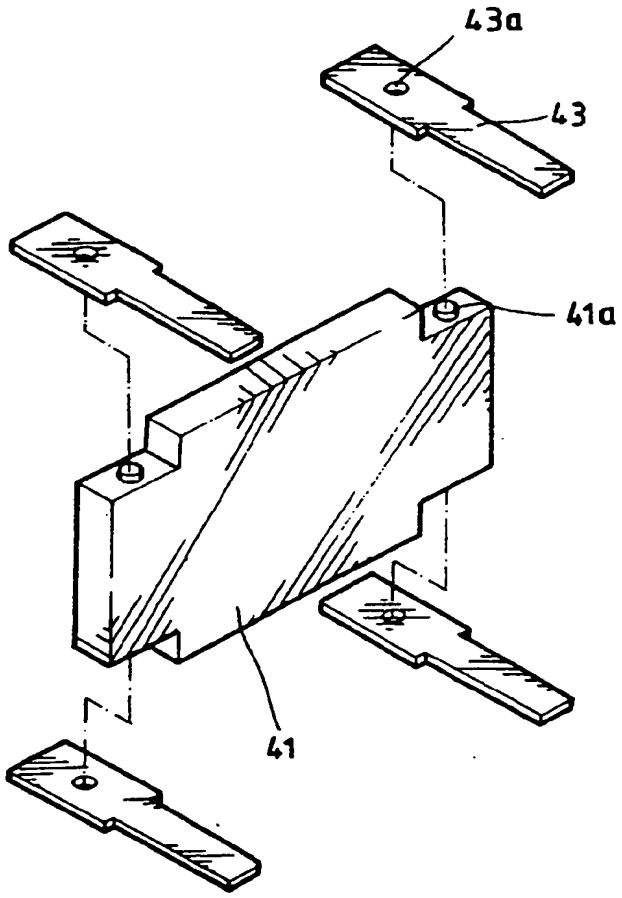


FIG. 5

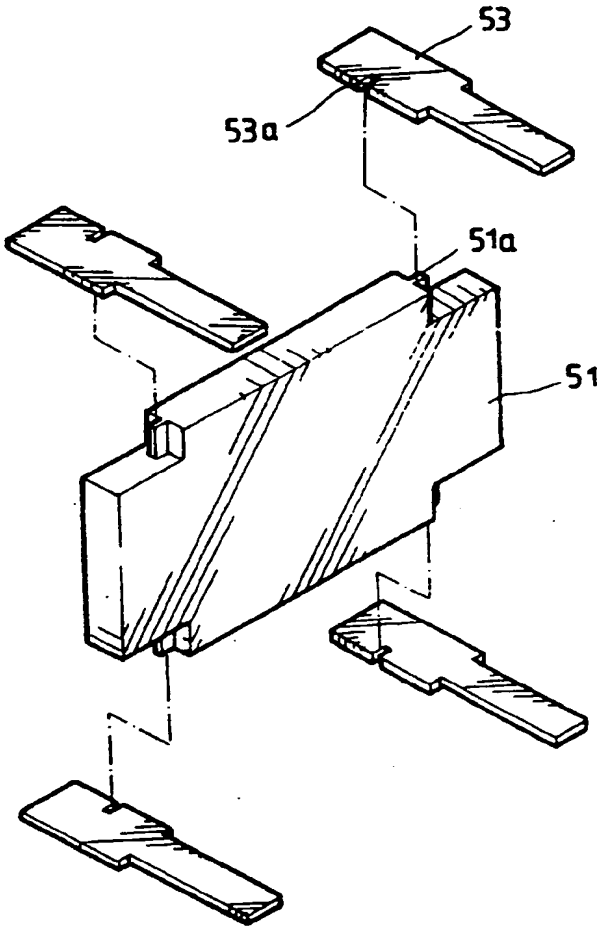
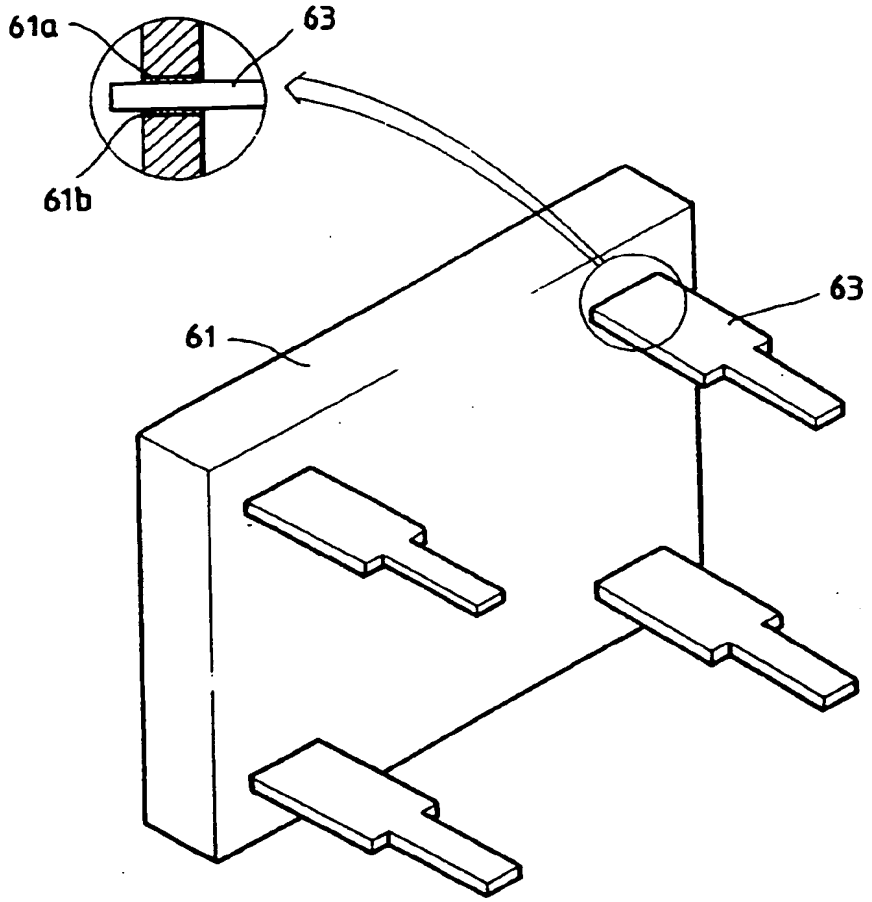


FIG. 6



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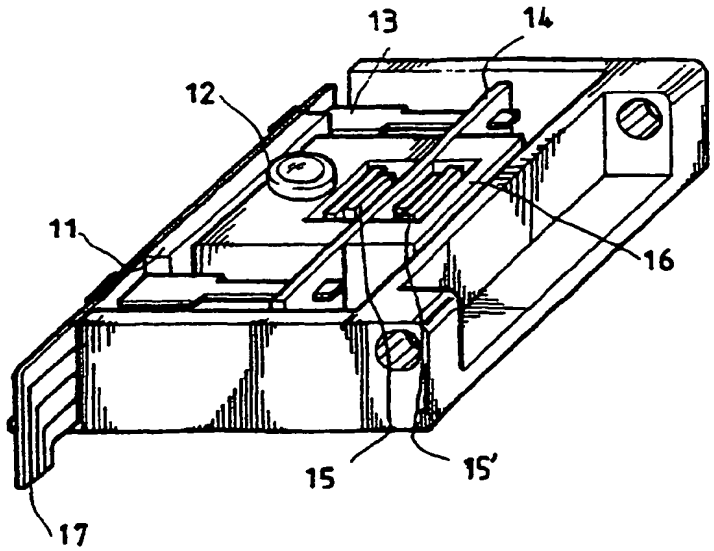

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European Patent Office

EUROPEAN SEARCH REPORT

Application Number EP 96304714.7

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 6)
X	EP 0376531 A1 (SONY CORP.) 04 July 1990 (04.07.90), fig. 4-15, claim 1, abstract, column 8, line 26 - column 11, line 53. --	1,2	G 11 B 7/12 G 11 B 7/095 G 11 B 7/09 G 11 B 7/08 G 11 B 7/00
A	US 5072433 A (TANAKA) 10 December 1991 (10.12.91), fig. 1,2, claim 1, abstract, column 3, line 1 - column 4, line 36. --	1,2	
A	US 5297127 A (OHTSUKA et al.) 22 March 1994 (22.03.94), abstract, fig. 1-3, column 2, lines 32-52. ----	1	

TECHNICAL FIELDS SEARCHED (Int. Cl. 6)

G 10 L 7/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	21-04-1998	BERGER

CATEGORY OF CITED DOCUMENTS

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